REMARKS

In the Office Action dated November 7, 2001, a typographical error at page 4 of the specification was noted, which has been corrected.

Additionally, in view of the arguments for patentability discussed below, the specification, claims and Abstract have been amended to make clear that the magnetic resonance antenna is a nuclear magnetic resonance antenna, i.e., it is for the purpose of exciting nuclear spins in an examination subject and for receiving the resulting magnetic resonance signals therefrom. Applicants submit this is clear from virtually the entirety of the original disclosure, but also the Oppelt et al. patent (United States Patent No. 5,153,517) was cited at page 1 of the present specification as describing a "magnetic resonance antenna of the above type." The Oppelt et al. reference, at column 1, lines 6-10 clearly makes reference to nuclear magnetic resonance. Therefore, no new matter is added by these changes.

Additionally, consistent with the arguments in support of patentability discussed below, claim 1 has been amended to state that the antenna elements exhibit cyclical symmetry from antenna element to antenna element. Support for this amendment to claim 1 is present in the original disclosure at page 4, lines 14-16.

Claims 1-13 were rejected under 35 U.S.C. §102(b) as being anticipated by McArthur, or alternatively under 35 U.S.C. §103(a) as being unpatentable over the McArthur reference. This rejection is respectfully traversed for the following reasons.

The Examiner characterized McArthur as teaching a multi-sector magnetic resonance device based on the use of the phrase "magnetic resonance" at column 1, line 63 of the McArthur reference. The use of the term "magnetic resonance" at that location in the McArthur reference, however, clearly is not intended to mean nuclear

magnetic resonance. The term "magnetic resonance" was used in that context in the McArthur to describe resonance of the type which is employed in a cyclotron or magnetotron in order to guide an electron beam in a vacuum around a curved path by means of a magnetic field. It is well-known for this purpose that the spacing of the electron path from a center of the apparatus can be adjusted by applying a suitable alternating voltage to D-shaped hollow bodies. The amendment of each of the claims to refer to a nuclear magnetic resonance antenna should be sufficient by itself to preclude further reliance on the McArthur reference. Even without this amendment, however, the McArthur reference clearly did not disclose any type of antenna, as set forth in claims 1-13 as originally filed.

The McArthur device is stated at numerous locations, including column 1, lines 15-20, to be for the purpose of generating a reactive current. A similar statement is made at column 1, lines 42-45 and lines 57-61 of the McArthur reference. For this purpose, it is expressly taught in the McArthur reference, such as at column 1, lines 57-61, that the device should exhibit an extremely low power factor. Those of ordinary skill in the art, for this reason alone, would clearly understand that the McArthur device cannot be an antenna. Energy is emitted or received with an antenna, thereby necessitating a non-reactive current flow. Interpreting the McArthur device as being antenna would thus be a direct contradiction to the intended purpose of the McArthur device and the intended manner of operation.

Moreover, at column 5, lines 51-60 of the McArthur reference, it is expressly mentioned twice that the device should provide a reactive current.

The McArthur reference therefore does not disclose an antenna, and more specifically does not disclose a nuclear magnetic resonance antenna. The McArthur

device therefore does not anticipate claim 1 or any of claims 2-13 depending therefrom. Moreover, for the reasons noted above if the McArthur device were modified in some manner not taught therein in order to try to "convert" the McArthur device into an antenna, this would destroy the intended manner of operation of the McArthur device, and therefore is not a permissible basis for supporting a rejection under 35 U.S.C. §103.

Claims 1-13, therefore, are patentable over the McArthur reference.

Claims 1-13 additionally were rejected under 35 U.S.C. §103(a) as being unpatentable over the aforementioned Oppelt et al. reference, either alone or alternatively in view of Figure 6 of the McArthur reference. The Examiner relied on a decision for the proposition that duplicating parts for a multiplied effect is not a patentably distinguishing feature. If the Examiner's reason for citing this decision was a belief that the only difference between the Oppelt et al. reference and the claimed subject matter is that the Oppelt et al. reference discloses four antenna elements, but the claimed subject matter requires at least five antenna elements, Applicants respectfully submit this is not the case. By using at least five antenna elements, a completely different result is obtained in the antenna disclosed and claimed in the present application, compared to the antenna disclosed in the Oppelt et al. reference. Moreover, it is of course true that the Oppelt et al. reference exhibits cyclical symmetry, but this requirement added to independent claim 1, in combination with the requirement that there be at least five antenna elements, results in an antenna which operates completely differently from the Oppelt et al. antenna.

In the Oppelt et al. reference, the four antenna elements form two sub-systems or sub-antennas that are *decoupled* from each other. This is described at column 5,

lines 21-22 and column 7, lines 33-36 in the Oppelt et al. reference. Such a decoupling of the two sub-systems is possible only when the two antenna elements of the two sub-systems are offset by 180° relative to each other, and the sub-systems themselves are offset by 90° relative to each other.

Only in the configuration shown in the Oppelt et al. reference can the sub-systems be operated decoupled from each other, namely with four antenna elements that are each offset by 90° relative to each other, with the antenna elements forming a sub-system being disposed opposite each other.

Coupling of the sub-systems or the antenna elements with each other, by contrast, will always occur for any other angle configuration. With at least five antenna elements and with the antenna elements exhibit cyclical symmetry from antenna element to antenna element, as set forth in claim 1, the antenna elements will be at least magnetically coupled with each other, in contrast to the intended decoupled operation of the Oppelt et al. reference. With the number of antenna elements being at least five, the offset angle from antenna element to antenna element will be 360°/5 = 72°, which means that the antenna elements will definitely be coupled with each other. Since it is the stated purpose of the Oppelt et al. antenna to achieve an arrangement wherein not only the sub-systems, but also the antenna elements are *decoupled* from each other, this requirement of Oppelt et al. cannot be met if the number of antenna elements is five or more, because the conditions required to achieve this result are that the offset angle be 90°, which is impossible to achieve if the number of antenna elements must be at least 5, as set forth in claim 1.

In the Office Action, the Examiner stated that the Oppelt et al. reference teaches that the antenna elements are at least magnetically coupled to each other, the

Examiner citing the Abstract and a passage in column 5 of the Oppelt et al. reference in support of this position. Applicants respectfully traverse this conclusion of the Examiner.

In the Abstract of the Oppelt et al. reference, it is merely mentioned that the magnetic fields generated by the sub-systems are oriented perpendicularly to each other, and are superimposed to form a circularly polarized overall field. No coupling of the two sub-systems is mentioned at all in the Abstract.

Moreover, the language at column 5 does not include any statement that a coupling of the antenna elements in the Oppelt et al. system occurs. To the contrary, it is explicitly stated at lines 21 and 22 of column 5 that the sub-systems are decoupled from each other. This statement also applies to the embodiment shown in Figure 6 of the Oppelt et al. reference. As stated at column 5, lines 62-65, a feed that is "balanced to ground" ensues in this embodiment. If, for example, a voltage U is applied to the antenna element 17 at the left of Figure 6, a voltage -U is simultaneously applied to the antenna element 17 at the right of Figure 6. A flow current in the antenna elements 18 therefore is not produced.

The current flow through the antenna elements 17, and in the outer ring around the antenna elements 17 and 18, generates a magnetic field, but this magnetic field does not produce a current flow in the antenna elements 18. To the contrary, these antenna elements 18 are uninfluenced, so that, as taught by Oppelt et al., the two sub-systems are decoupled from each other.

Therefore, modifying the Oppelt et al. reference to employ five antenna elements, instead of the four antenna elements as disclosed in the Oppelt et al. reference, would destroy the intended operation of the Oppelt et al. reference, and thus

such a modification cannot serve as a basis for a rejection under 35 U.S.C. §103, with or without the additional reliance on the McArthur reference. As noted above, the McArthur reference is not even a nuclear magnetic resonance antenna, and it is not even seen how the Oppelt et al. structure and the McArthur structure could be physically combined. Applicants recognize that it is not necessary, to support a rejection under 35 U.S.C. §103, that two references be physically combinable, but there must be at least some hope that an operable structure would result. In view of the above discussion, Applicants see no way that Oppelt et al. and McArthur could be combined to result in an operative structure of any type, much less a nuclear magnetic resonance antenna wherein the antenna elements are at least magnetically coupled to each other.

All claims of the application are therefore submitted to be in condition for allowance, and early reconsideration of the application is respectfully requested.

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE SPECIFICATION

Please amend the paragraph immediately below the head "Field of the invention" at page 1, as follows:

The present invention relates to a magnetic resonance antenna for nuclear magnetic resonance systems with a vertical basic field, the magnetic resonance antenna being of the type having a number of antenna elements that extend substantially radially from an inner element to at least one outer element, relative to a center axis, the antenna elements being at least magnetically coupled with one another.

Please amend the paragraph beginning on page 3, line 26 as follows:

Figure 5 is a [prospective] perspective view of a magnetic resonance antenna constructed in accordance with principals of the present invention.

Please amend the paragraph beginning on page 4, line 17 as follows:

The magnetic resonance antenna has two connections 7, which, offset by 90°, are arranged at the outer connecting element 6. At these two connections 7, two currents that are phase-shifted by 90° can be alternatively coupled in or coupled out with a magnetic resonance frequency f. As a result, a circularly polarized magnetic field can be alternatively emitted or received with the magnetic resonance antenna according to Figure 1. The magnetic resonance frequency usually lies between 8 MHZ and 100 MHZ. The currents and magnetic fields that flow at a specific point in time are indicated in Figure 1 by means of the normal symbols.

IN THE CLAIMS

Please amend claim 1 as follows:

1. (Amended) A nuclear magnetic resonance antenna comprising:

a plurality of antenna elements, each antenna having an element beginning and an element end;

said antenna elements being disposed radially relative to a center axis so as to proceed outwardly from the respective element beginnings to the respective element ends and exhibiting cyclical symmetry from antenna element to antenna element;

said antenna elements being at least magnetically coupled with each other; and

said plurality being at least five.

Please amend claim 2 as follows:

2. (Amended) A nuclear magnetic resonance antenna as claimed in claim 1, wherein the respective element beginnings and the respective element ends are connected to ground.

Please amend claim 3 as follows:

3. (Amended) A nuclear magnetic resonance antenna as claimed in claim 1 wherein said antenna elements are electrically coupled to each other.

Please amend claim 4 as follows:

4. (Amended) A nuclear magnetic resonance antenna as claimed in claim 3 wherein the respective element beginnings are electrically connected to each other via a ring-shaped connecting element.

Please amend claim 5 as follows:

5. (Amended) A nuclear magnetic resonance antenna as claimed in claim 3 wherein the respective element ends are electrically connected to each other via a ring-shaped connecting element.

Please amend claim 6 as follows:

6. (Amended) A nuclear magnetic resonance antenna as claimed in claim 3 wherein the respective element beginnings are electrically connected to each other via a first ring-shaped connecting element and wherein the respective element ends are electrically connected to each other via a second ring-shaped connecting element.

Please amend claim 7 as follows:

7. (Amended) A nuclear magnetic resonance antenna as claimed in claim 1, wherein each of said antenna elements has two branching element ends.

Please amend claim 8 as follows:

8. (Amended) A nuclear magnetic resonance antenna as claimed in claim 1 wherein the respective element beginnings define an element beginning plane and wherein the respective element ends defines an element end plane, and wherein said element beginning plane and said element end plane are parallel to and spaced from each other.

Please amend claim 9 as follows:

9. (Amended) A nuclear magnetic resonance antenna as claimed in claim 8 wherein the respective antenna elements are linear.

Please amend claim 10 as follows:

10. (Amended) A nuclear magnetic resonance antenna as claimed in claim 8 wherein the respective antenna elements define respective line directions, said line directions intersecting said center axis at a common point.

Please amend claim 11 as follows:

11. (Amended) A nuclear magnetic resonance antenna as claimed in claim 10 further comprising a grounding plate disposed parallel to said element beginning plane and said element end plane, and said common point being disposed in said grounding plate.

Please amend claim 12 as follows:

12. (Amended) A nuclear magnetic resonance antenna as claimed in claim 8 further comprising a grounding plate disposed parallel to said element beginning plane and said element end plane.

Please amend claim 13 as follows:

13. (Amended) A nuclear magnetic resonance antenna as claimed in claim 1 wherein said plurality is divisible for four.

IN THE ABSTRACT

Please amend the Abstract on page 9 as follows:

A nuclear magnetic resonance antenna has at least five antenna elements, each of, which extends essentially radially from an inner element beginning to at least one outer element end with respect to a center axis. The antenna elements are at least magnetically coupled with one another.